That which is claimed is:

1. A process for the production of products which are liquid at ambient conditions and contain organic sulfur compounds of higher molecular weight than corresponding sulfur-containing compounds in the feedstock, which process comprises:

providing a feedstock comprising a mixture of hydrocarbons which includes olefins, and sulfur-containing organic compounds and nitrogen-containing organic compounds, the feedstock consisting essentially of material boiling between about 60° C. and about 345° C. and having a sulfur content up to about 4,000 or 5,000 parts per million and a nitrogen content up to about 2,000 parts per million;

passing the feedstock through a bed of solid adsorbent, under conditions suitable for adsorption within the bed, to effect selective adsorption and/or complexing of at least a portion of the contained nitrogen-containing organic compounds with the adsorbent, and thereby obtain effluent from the bed which contains less of nitrogen-containing organic compounds than the feedstock;

in a first contacting stage at elevated temperatures, contacting the effluent with an acidic catalyst under conditions which are effective to convert a portion of the impurities to a sulfur-containing material of higher molecular weight through alkylation by the olefins, thereby forming an initial product stream; and

in a subsequent contacting stage and at temperatures at least 10° C lower than an average of the elevated temperatures in the first contacting stage, contacting at least a portion of the initial product stream with an acidic catalyst under conditions which are effective to convert a portion of the impurities to a sulfur-containing material of higher molecular weight through alkylation by the olefins, thereby forming a subsequent product stream.

2. The process of claim 1 wherein the petroleum feedstock is comprised of a naphtha from a catalytic cracking process and/or a thermal cracking process.

3. The process of claim 1 wherein the solid adsorbent is comprised of a material which is prepared from an acidic catalyst by use in at least one of the contacting stages.

4. The process of claim 1 wherein the olefin content of the feedstock is at least equal on a molar basis to that of the sulfur-containing organic compounds.

5. The process of claim 1 wherein a solid phosphoric acid catalyst is used as the acidic catalyst in at least one of the contacting stages.

6. The process of claim 1 wherein the elevated temperatures used in the initial contacting stage are in a range from about 100° C to about 235° C.

7. The process of claim 1 wherein the acidic catalyst of the subsequent contacting stage is comprised of a material which is prepared from an acidic catalyst by use in the first contacting stage, and the solid adsorbent is comprised of a material which is prepared from the acidic catalyst by use in the first contacting stage and/or the subsequent contacting stage.

8. The process of claim 1 wherein the acidic catalyst is comprised of a solid phosphoric acid catalyst, and wherein the feedstock is comprised of a hydrating agent in an amount which exhibits a capability to enhance performance of the catalyst.

9. The process of claim 8 wherein the hydrating agent is at least one member of the group consisting of alkanols having from about 2 to about 5 carbon atoms.

10. The process of claim 8 wherein the temperatures in the subsequent contacting stage are at least 15° C lower than an average of the elevated temperatures in the initial contacting stage.

11. A process for the production of products which are liquid at ambient conditions and have a reduced sulfur content relative to the feedstock, which process comprises:

providing a feedstock comprising a mixture of hydrocarbons which includes olefins and sulfur-containing organic compounds, the feedstock consisting essentially of material boiling between about 60° C. and about 345° C. and having a sulfur content up to about 4,000 or 5,000 parts per million;

passing the feedstock through a bed of solid adsorbent, under conditions suitable for adsorption within the bed, to effect selective adsorption and/or complexing of at least a portion of the contained nitrogen-containing organic compounds with the adsorbent, and thereby obtain effluent from the bed which contains less of nitrogen-containing organic compounds than the feedstock;

in a first contacting stage at elevated temperatures, contacting the feedstock with an acidic catalyst under conditions which are effective to convert a portion of the impurities to a sulfur-containing material of higher boiling point through alkylation by the olefins, thereby forming an initial product stream;

in a subsequent contacting stage and at temperatures at least 10° C lower than an average of the elevated temperatures in the initial contacting stage, contacting at least a portion of the initial product stream with an acidic catalyst under conditions which are

effective to convert a portion of the impurities to a sulfur-containing material of higher boiling point through alkylation by the olefins, thereby forming a subsequent product stream; and

fractionating the subsequent product stream by distillation to provide at least one low-boiling fraction consisting of a sulfur-lean, fraction having a sulfur content less than about 50 ppm, and a high-boiling fraction consisting of a sulfur-rich, fraction containing the balance of the sulfur.

12. The process of claim 11 wherein the solid adsorbent is comprised of a material which is prepared from an acidic catalyst by use in at least one of the contacting stages.

13. The process of claim 11 wherein the olefin content of the feedstock is at least equal on a molar basis to that of the sulfur-containing organic compounds, and wherein the acidic catalyst of the subsequent contacting stage is comprised of a material which is prepared from an acidic catalyst by use in the first contacting stage, and the solid adsorbent is comprised of a material which is prepared from the acidic catalyst by use in the first contacting stage and/or the subsequent contacting stage.

14. The process of claim 11 wherein the elevated temperatures used in the initial contacting stage are in a range from about 100° C to about 235° C.

15. The process of claim 11 wherein the acidic catalyst in at least one of the contacting stages is a solid phosphoric acid catalyst, and wherein the feedstock is comprised of a hydrating agent in an amount which exhibits a capability to enhance performance of the catalyst.

16. The process of claim 11 wherein the elevated temperatures used in the initial contacting stage are in a range from about 110° C to about 220° C, and wherein the temperatures used in the subsequent contacting stage is at least 30° C lower than an average of the elevated temperatures in the initial contacting stage.

17. The process of claim 8 wherein the one low-boiling fraction has a distillation end point and the high-boiling fraction has an initial boiling point such that the distillation end point and the initial boiling point are in the range from about 80° C to about 220° C.

18. The process of claim 8 wherein the high-boiling fraction has a distillation end point which is below about 249° C.

19. A process for the production of products which are liquid at ambient conditions and have a reduced sulfur content relative to the feedstock, which process comprises:

providing a feedstock comprising a mixture of hydrocarbons which includes olefins and sulfur-containing organic compounds, the feedstock consisting essentially of material boiling between about 60° C. and about 345° C. and having a sulfur content up to about 5,000 parts per million;

passing the feedstock through a bed of solid adsorbent, under conditions suitable for adsorption within the bed, to effect selective adsorption and/or complexing of at least a portion of the contained nitrogen-containing organic compounds with the adsorbent, and thereby obtain effluent from the bed which contains less of nitrogen-containing organic compounds than the feedstock;

in a first contacting stage at elevated temperatures, contacting the feedstock with an acidic catalyst under conditions which are effective to convert a portion of the impurities to a sulfur-containing material of higher boiling point through alkylation by the olefins, thereby forming an initial product stream;

in a subsequent contacting stage and at temperatures at least 10° C lower than an average of the elevated temperatures in the initial contacting stage, contacting at least a portion of the initial product stream with an acidic catalyst under conditions which are effective to convert a portion of the impurities to a sulfur-containing material of higher boiling point through alkylation by the olefins, thereby forming a subsequent product stream;

fractionating the subsequent product stream by distillation to provide at least one low-boiling fraction consisting of a sulfur-lean, mono-aromatic-rich fraction having a sulfur content less than about 50 ppm, and a high-boiling fraction consisting of a sulfur-rich, mono-aromatic-lean fraction containing the balance of the sulfur;

treating the high-boiling fraction with a gaseous source of dihydrogen at hydrogenation conditions in the presence of a hydrogenation catalyst which exhibits a capability to enhance the incorporation of hydrogen into one or more of the sulfur-containing organic compounds and under conditions suitable for hydrogenation of one or more of the sulfur-containing organic compounds; and

recovering a high-boiling liquid having a sulfur content less than about 50 ppm.

20. The process according to claim 19 wherein the hydrogenation catalyst comprises at least one active metal, selected from the group consisting of the *d*-transition elements, each incorporated onto an inert support in an amount of from about 0.1 percent to about 20 percent by weight of the total catalyst.

21. The process according to claim 19 wherein the hydrogenation catalyst comprises one or more metals selected from the group consisting of cobalt, nickel, molybdenum and tungsten.

22. The process according to claim 19 wherein the olefin content of the feedstock is at least equal on a molar basis to that of the sulfur-containing organic compounds, and wherein the solid adsorbent is comprised of a material which is prepared from an acidic catalyst by use in at least one of the contacting stages.

23. The process according to claim 19 wherein the acidic catalyst of the subsequent contacting stage is comprised of a material which is prepared from an acidic catalyst by use in the first contacting stage, and the solid adsorbent is comprised of a material which is prepared from the acidic catalyst by use in the first contacting stage and the subsequent contacting stage.

24. The process according to claim 19 wherein the treating of the high-boiling fraction with a gaseous source of dihydrogen employs at least one bed of hydrogenation catalyst comprising nickel and one or more metals selected from the group consisting of, molybdenum and tungsten, each incorporated onto an inert support in an amount of from about 0.1 percent to about 20 percent by weight of the total catalyst.

25. A composition suitable for refinery blending of transportation fuels products which are liquid at ambient conditions, and having a sulfur content of less than about 50 ppm and is formed by a process which comprises:

providing a feedstock comprising a mixture of hydrocarbons which includes olefins and sulfur-containing organic compounds, the feedstock consisting essentially of material boiling between about 60° C. and about 345° C. and having a sulfur content up to about 2,500 ppm;

passing the feedstock through a bed of solid adsorbent, under conditions suitable for adsorption within the bed, to effect selective adsorption and/or complexing of at least a portion of the contained nitrogen-containing organic compounds with the adsorbent, and thereby obtain effluent from the bed which contains less of nitrogen-containing organic compounds than the feedstock;

in a first contacting stage at elevated temperatures, contacting the feedstock with an acidic catalyst under conditions which are effective to convert a portion of the impurities to a sulfur-containing material of higher boiling point through alkylation by the olefins, thereby forming an initial product stream;

in a subsequent contacting stage and at temperatures at least 10° C lower than an average of the elevated temperatures in the initial contacting stage, contacting at least a

portion of the initial product stream with an acidic catalyst under conditions which are effective to convert a portion of the impurities to a sulfur-containing material of higher boiling point through alkylation by the olefins, thereby forming a subsequent product stream; and

fractionating the subsequent product stream by distillation to provide at least one low-boiling fraction consisting of a sulfur-lean, fraction having a sulfur content less than about 50 ppm, and a high-boiling fraction consisting of a sulfur-rich, fraction containing the balance of the sulfur.